

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2018

PES 0024 – ESSENTIAL STATISTICS

(All sections / Groups)

13 March 2019

9am – 11am

(2Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 9 pages, with 4 questions only.
2. Attempt **ALL** FOUR questions. The distribution of marks for each question is given.
3. Please print all your answers in the answer booklet provided.
4. A Formulae sheet is provided at the back of the question paper.

Question 1 (25 marks)

- (a) The following data gives the yearly rental (in thousands of dollars) for selected units in a new township.

21 30 15 12 36 26 25 19

Assuming that these are sample data, calculate the following correct to 2 decimal places, where appropriate:

- (i) Mean (2 marks)
- (ii) Median (3 marks)
- (iii) Mode (2 marks)
- (iv) Standard Deviation (5 marks)
- (v) Range (2 marks)

- (b) The data below is the selling price for books published by Preston Publications

40 37 25 37 27 28 22 24 33 27
34 22 28 21 22 29 35 26 24 38

- (i) Construct a frequency distribution table for these data using four classes (21-25, 26-30, 31-35, 36-40). Then determine the percentage frequency distribution together with the cumulative percentage frequency for each class. Include also, a row for the total. (6 marks)
- (ii) Interpret the percentage frequency for the class with age 31-35 using the table in (i). (2 marks)
- (iii) Interpret the cumulative percentage frequency for the class with age 31-35 using the table in (i). (2 marks)
- (iv) State the type of data collected by Preston Publications (1 mark)

Continued...

Question 2 (25 marks)

- a. A punter in the local horse racing circuit, has predicted a probability of about 0.33, that the favorite in a horse race will finish *in the money* (first, second, or third place). In the next five races, what is the probability that the favorite finishes *in the money*
- i. Exactly twice? (3 marks)
 - ii. Exactly four times? (3 marks)
 - iii. At least four times? (3 marks)
 - iv. What is the mean and standard deviation of the favorite in the horse race that will finish *in the money*? (3 marks)
- b. A computer centre manager reports that his computer system experienced four component failures during the past 100 days.
- i. What is the probability of no failures in a given day? (2 marks)
 - ii. What is the probability of exactly 7 failures in a 55-day period? (3 marks)
- c. A statistical analysis of 1,000 long-distance telephone calls made from the headquarters of the Dream City Corporation indicates that the length of these calls is normal with an average of 240 seconds and standard deviation of 40 seconds. You are required to compute:
- i. What is the probability that a call lasted more than 280 seconds? (4 marks)
 - ii. What is the probability that a call lasted between 220 and 350 seconds? (4 marks)

Continued...

Question 3 (25 marks)

- a. The table below indicates the number of annual leave applied by four staff of Aneka Departmental Store in the month of December.

Staff	Number of annual leave
Ali	3
Barry	2
Chong	1
Deepak	4

List all the possible samples of two staff (without replacement) from this population and construct the sampling distribution of the sample mean.

11 marks)

- b. The time spent using email per session is normally distributed with $\mu = 8$ minutes and $\sigma = 2$ minutes. If you select a random sample of 25 sessions:
- Find the probability that the sample mean is between 7.9 and 8.1 minutes. (4 marks)
 - Find the probability of the sample mean between 7.9 and 8.1 minutes given that a random sample of 49 sessions is selected. (4 marks)
 - Explain the difference in the results of (i) and (ii). (2 marks)
 - If you select a random sample of 25 sessions, there is 85% chance that the sample mean is less than how many minutes? (4 marks)

Continued...

Question 4 (25 marks)

- a. A manufacturer claims that the mean battery life of all laptops that the company produce is at least 17 hours. An independent consumer-protection agency wishes to test the credibility of the manufacturer's claim and measures the battery life of a random sample of 30 laptops from a recently produced batch. The results, in hours, are as follows:

17	18	21	17	10
15	19	11	25	19
27	22	23	21	26
24	26	28	30	25
14	13	15	15	16
12	11	13	18	17

- i. Calculate the sample mean and sample standard deviation of the recorded data. Leave your answers in 2 decimal places. (7 marks)
 - ii. What is the point estimate of the mean battery life of all laptops produced by the company? (1 mark)
 - iii. Construct a 95% confidence interval for the mean battery life of all laptops produced by the company. Assume that the standard deviation for the population is 4.2. (6 marks)
- b. The Table below gives the consumer's responses as to whether the television purchased was an HDTV and whether they had also purchased a DVD player in the last 12 months.

Purchased HDTV	Purchased DVD		Total
	Yes	No	
HDTV	48	34	82
Not HDTV	98	180	278
Total	146	214	360

Continued...

Suppose a household that purchased a widescreen television is randomly selected:
(Present all answers correct to 2 decimal places)

- i. What is the probability that a household purchased DVD player?
(3 marks)
- ii. What is the probability that a household did not purchased HDTV?
(3 marks)
- iii. Given that a household purchased HDTV, what is the probability that the household also purchased DVD player?
(3 marks)
- iv. Given that the household selected did not purchased DVD, what is the probability that the household purchased HDTV?
(2 marks)

End of Page

Formula Sheet

Descriptive Statistics

	<u>Population</u>	<u>Sample</u>
<i>Ungrouped Data</i>		
Mean	$\mu = \frac{\sum x}{N}$	$\bar{x} = \frac{\sum x}{n}$
Variance	$\sigma^2 = \frac{\sum (x - \mu)^2}{N}$	$s^2 = \frac{\sum (x - \bar{x})^2}{n - 1}$
	OR	
	$\sigma^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N}$	$s^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n - 1}$
Standard Deviation	$\sigma = \sqrt{\sigma^2}$	$s = \sqrt{s^2}$
<i>Grouped data</i>		
Mean	$\mu = \frac{\sum fm}{N}$	$\bar{x} = \frac{\sum fm}{n}$
Variance	$\sigma^2 = \frac{\sum f(m - \mu)^2}{N}$	$s^2 = \frac{\sum f(m - \bar{x})^2}{n - 1}$
	OR	
	$\sigma^2 = \frac{\sum fm^2 - \frac{(\sum fm)^2}{N}}{N}$	$s^2 = \frac{\sum fm^2 - \frac{(\sum fm)^2}{n}}{n - 1}$
Standard Deviation	$\sigma = \sqrt{\sigma^2}$	$s = \sqrt{s^2}$
Median	$\frac{(n+1)^{th}}{2} \text{ observation of data}$	

Probability Distributions

Discrete

Binomial Distribution

$$\mu = np$$

$$\sigma = \sqrt{npq}$$

Continuous

Normal Distribution

$$z = \frac{x - \mu}{\sigma}$$

Sampling Distributions

Mean

$$\mu_x = \mu$$

Standard Deviation

$$\sigma_x = \frac{\sigma}{\sqrt{n}}$$

Estimation

Confidence Interval

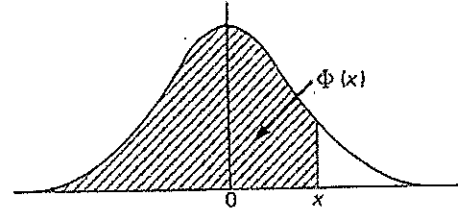
$$\bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

Random Variables	Mean	Variance
Discrete	$\sum x \cdot p(x)$	$\sum x^2 \cdot p(x) - \mu^2$
Continuous	$\int_{-\infty}^{\infty} x \cdot f(x) dx$	$\int_{-\infty}^{\infty} x^2 \cdot f(x) dx - \mu^2$

TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

The function tabulated is $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-t^2/2} dt$. $\Phi(x)$ is

the probability that a random variable, normally distributed with zero mean and unit variance, will be less than or equal to x . When $x < 0$ use $\Phi(x) = 1 - \Phi(-x)$, as the normal distribution with zero mean and unit variance is symmetric about zero.



x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
0.00	0.5000	0.40	0.6554	0.80	0.7881	1.20	0.8849	1.60	0.9452	2.00	0.97725
0.01	5040	0.41	6591	0.81	7910	0.21	8869	0.61	9463	0.01	97778
0.02	5080	0.42	6628	0.82	7939	0.22	8888	0.62	9474	0.02	97831
0.03	5120	0.43	6664	0.83	7967	0.23	8907	0.63	9484	0.03	97882
0.04	5160	0.44	6700	0.84	7995	0.24	8925	0.64	9495	0.04	97932
0.05	5199	0.45	6736	0.85	8023	1.25	0.8944	1.65	0.9505	2.05	0.97982
0.06	5239	0.46	6772	0.86	8051	0.26	8962	0.66	9515	0.06	98030
0.07	5279	0.47	6808	0.87	8078	0.27	8980	0.67	9525	0.07	98077
0.08	5319	0.48	6844	0.88	8106	0.28	8997	0.68	9535	0.08	98124
0.09	5359	0.49	6879	0.89	8133	0.29	9015	0.69	9545	0.09	98169
0.10	5398	0.50	6915	0.90	8159	1.30	0.9032	1.70	0.9554	2.10	0.98214
0.11	5438	0.51	6950	0.91	8186	0.31	9049	0.71	9564	0.11	98257
0.12	5478	0.52	6985	0.92	8212	0.32	9066	0.72	9573	0.12	98300
0.13	5517	0.53	7019	0.93	8238	0.33	9082	0.73	9582	0.13	98341
0.14	5557	0.54	7054	0.94	8264	0.34	9099	0.74	9591	0.14	98382
0.15	5596	0.55	7088	0.95	8289	1.35	0.9115	1.75	0.9599	2.15	0.98422
0.16	5636	0.56	7123	0.96	8315	0.36	9131	0.76	9608	0.16	98461
0.17	5675	0.57	7157	0.97	8340	0.37	9147	0.77	9616	0.17	98500
0.18	5714	0.58	7190	0.98	8365	0.38	9162	0.78	9625	0.18	98537
0.19	5753	0.59	7224	0.99	8389	0.39	9177	0.79	9633	0.19	98574
0.20	5793	0.60	7257	1.00	8413	1.40	0.9192	1.80	0.9641	2.20	0.98610
0.21	5832	0.61	7291	0.01	8438	0.41	9207	0.81	9649	0.21	98645
0.22	5871	0.62	7324	0.02	8461	0.42	9222	0.82	9656	0.22	98679
0.23	5910	0.63	7357	0.03	8485	0.43	9236	0.83	9664	0.23	98713
0.24	5948	0.64	7389	0.04	8508	0.44	9251	0.84	9671	0.24	98745
0.25	5987	0.65	7422	1.05	8531	1.45	0.9265	1.85	0.9678	2.25	0.98778
0.26	6026	0.66	7454	0.06	8554	0.46	9279	0.86	9686	0.26	98809
0.27	6064	0.67	7486	0.07	8577	0.47	9292	0.87	9693	0.27	98840
0.28	6103	0.68	7517	0.08	8599	0.48	9306	0.88	9699	0.28	98870
0.29	6141	0.69	7549	0.09	8621	0.49	9319	0.89	9706	0.29	98899
0.30	6179	0.70	7580	1.10	8643	1.50	0.9332	1.90	0.9713	2.30	0.98928
0.31	6217	0.71	7611	0.11	8665	0.51	9345	0.91	9719	0.31	98956
0.32	6255	0.72	7642	0.12	8686	0.52	9357	0.92	9726	0.32	98983
0.33	6293	0.73	7673	0.13	8708	0.53	9370	0.93	9732	0.33	99010
0.34	6331	0.74	7704	0.14	8729	0.54	9382	0.94	9738	0.34	99036
0.35	6368	0.75	7734	1.15	8749	1.55	0.9394	1.95	0.9744	2.35	0.99061
0.36	6406	0.76	7764	0.16	8770	0.56	9406	0.96	9750	0.36	99086
0.37	6443	0.77	7794	0.17	8790	0.57	9418	0.97	9756	0.37	99111
0.38	6480	0.78	7823	0.18	8810	0.58	9429	0.98	9761	0.38	99134
0.39	6517	0.79	7852	0.19	8830	0.59	9441	0.99	9767	0.39	99158
0.40	6554	0.80	7881	1.20	8849	1.60	0.9452	2.00	0.9772	2.40	0.99180

TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
2.40	0.99180	2.55	0.99461	2.70	0.99653	2.85	0.99781	3.00	0.99865	3.15	0.99918
41	.99202	56	.99477	71	.99664	86	.99788	01	.99869	16	.99921
42	.99224	57	.99492	72	.99674	87	.99795	02	.99874	17	.99924
43	.99245	58	.99506	73	.99683	88	.99801	03	.99878	18	.99926
44	.99266	59	.99520	74	.99693	89	.99807	04	.99882	19	.99929
2.45	0.99286	2.60	0.99534	2.75	0.99702	2.90	0.99813	3.05	0.99886	3.20	0.99931
46	.99305	61	.99547	76	.99711	91	.99819	06	.99889	21	.99934
47	.99324	62	.99560	77	.99720	92	.99825	07	.99893	22	.99936
48	.99343	63	.99573	78	.99728	93	.99831	08	.99896	23	.99938
49	.99361	64	.99585	79	.99736	94	.99836	09	.99900	24	.99940
2.50	0.99379	2.65	0.99598	2.80	0.99744	2.95	0.99841	3.10	0.99903	3.25	0.99942
51	.99396	66	.99609	81	.99752	96	.99846	11	.99906	26	.99944
52	.99413	67	.99621	82	.99760	97	.99851	12	.99910	27	.99946
53	.99430	68	.99632	83	.99767	98	.99856	13	.99913	28	.99948
54	.99446	69	.99643	84	.99774	99	.99861	14	.99916	29	.99950
2.55	0.99461	2.70	0.99653	2.85	0.99781	3.00	0.99865	3.15	0.99918	3.30	0.99952

The critical table below gives on the left the range of values of x for which $\Phi(x)$ takes the value on the right, correct to the last figure given; in critical cases, take the upper of the two values of $\Phi(x)$ indicated.

3.075	0.9990	3.263	0.9994	3.731	0.99990	3.916	0.99995
3.105	0.9990	3.320	0.9995	3.759	0.99991	3.976	0.99996
3.138	0.9991	3.389	0.9996	3.791	0.99992	4.055	0.99997
3.174	0.9992	3.480	0.9997	3.826	0.99993	4.173	0.99998
3.215	0.9993	3.615	0.9998	3.867	0.99994	4.417	0.99999
	0.9994		0.9999		0.99995		1.00000

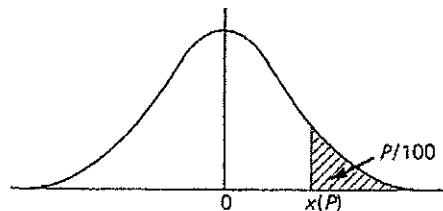
When $x > 3.3$ the formula $1 - \Phi(x) \div \frac{e^{-1/2x^2}}{x\sqrt{2\pi}} \left[1 - \frac{1}{x^2} + \frac{3}{x^4} - \frac{15}{x^6} + \frac{105}{x^8} \right]$ is very accurate, with relative error less than $945/x^{10}$.

TABLE 5. PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

This table gives percentage points $x(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{2\pi}} \int_{x(P)}^{\infty} e^{-t^2/2} dt.$$

If X is a variable, normally distributed with zero mean and unit variance, $P/100$ is the probability that $X \geq x(P)$. The lower P per cent points are given by symmetry as $-x(P)$, and the probability that $|X| \geq x(P)$ is $2P/100$.



P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$
50	0.0000	5.0	1.6449	3.0	1.8808	2.0	2.0537	1.0	2.3263	0.10	3.0902
45	0.1257	4.8	1.6646	2.9	1.8957	1.9	2.0749	0.9	2.3656	0.09	3.1214
40	0.2533	4.6	1.6849	2.8	1.9110	1.8	2.0969	0.8	2.4089	0.08	3.1559
35	0.3853	4.4	1.7060	2.7	1.9268	1.7	2.1201	0.7	2.4573	0.07	3.1947
30	0.5244	4.2	1.7279	2.6	1.9431	1.6	2.1444	0.6	2.5121	0.06	3.2389
25	0.6745	4.0	1.7507	2.5	1.9600	1.5	2.1701	0.5	2.5758	0.05	3.2905
20	0.8416	3.8	1.7744	2.4	1.9774	1.4	2.1973	0.4	2.6521	0.01	3.7190
15	1.0364	3.6	1.7991	2.3	1.9954	1.3	2.2262	0.3	2.7478	0.005	3.8906
10	1.2816	3.4	1.8250	2.2	2.0141	1.2	2.2571	0.2	2.8782	0.001	4.2649
5	1.6449	3.2	1.8522	2.1	2.0335	1.1	2.2904	0.1	3.0902	0.0005	4.4172

